INDUSTRIAL HYGIENE SECTION

This Industrial Hygiene Section is published to promote sound thought upon and concerning industrial hygiene. To that end it will contain articles, discussions, news items, reports, digests, and other presentations, together with editorial comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg. U. S. Pat. Off.

The Editorial Committee will exercise its best judgment in selecting for publication the material which presents most exactly the factors affecting industrial health and developments for control of potentially injurious exposures. The editors may not concur in opinions expressed by the authors but will endeavor to assure authenticity of fact.

The Science, the Law and the Economics of Industrial Health

Volume 4 | July, 1943 | Section 3

CONTENTS

HOW PATHOLOGIC is Discomfort? 489

DONALD E. CUMMINGS, 1900-1942 ..... By *LeRoy U. Gardner* 490

GOVERNMENTAL Industrial Hygiene Practice in 1942 491
By *J. J. Bloomfield*

INDUSTRIAL Hygiene in Synthetic Rubber Manufacture 495
By *F. S. Mallette*

ADMINISTRATIVE and Working Relationships Between the Georgia Industrial Hygiene Service and the United States Maritime Commission ..... By *Lester M. Petrie, M.D.*, 500

NEWS of Local Sections 502

How Pathologic is Discomfort?

AN INCREASING tendency is being manifested in the use of discomfort as a criterion for the establishment of threshold limits of atmospheric contaminants in industrial atmospheres. The inclination to pay more attention to the provision of comfortable working environment is a worthy one and should be furthered. Such conditions exert a desirable effect on production, and on industrial relations, together with an improvement in general health levels.

The industrial hygienist in discussing and reporting on industrial conditions should include reference to obnoxious elements even though his experience or his tests may show clearly that they have no injurious action on the body. In addition to the sensory response of the investigator himself and complaints by the workers, the industrial hygienist may well refer his findings to the increasing literature on concentrations of atmospheric contaminants which are considered objectionable on the basis of discomforting reactions. Weight should be given to the type of results reported elsewhere in this issue, showing response of workers to carbon tetrachloride vapor under actual industrial conditions, and also to the results shortly to be published of experiments wherein a group reported their reactions to a series of known concentrations of atmospheric contaminants in a test chamber at Harvard.

In according more attention to such subjective responses, a caution is to be sounded that discomfort is not necessarily indicative of pathology. In full recognition of the value of the best possible working conditions from the point of view of comfort, it is not to be accepted as a foregone conclusion that obnoxious conditions such as clouds of iron oxide fume or noticeable odors of acetone or ethyl acetate are to be considered poisonous merely on the grounds that new workers may find them discomforting, particularly during the first few days in the occupation. Complaints of such conditions should not go disregarded, but they do not necessarily mean that the atmosphere is injurious.

In determining whether working conditions may cause occupational disease, it is essential that standards on toxic limits be based on injury to health. Where there has been extensive experience among men working with potentially injurious materials such as lead, toxic limits can be set up which reflect very closely just what concentrations and amounts of material can be considered non-injurious to health. Where the experience in industrial operations has not been sufficiently extensive to be statistically significant, then we must resort to results of animal experimentations. The interpretation of such results should be made on the basis of knowledge of the relative reaction of various types of animals in comparison to that of man. Also, analogies can be drawn between the materials in question and the other materials similar in chemical structure on which we may have reliable pathological data. There are to be sure more or less well recognized pitfalls in the use of both animal experimentation and analogies between similar substances. It is often necessary to set up tentative standards of toxic limits on the basis of such data, with the provision of safety factors considered by competent toxicologists to be ample. These tentative standards should then be verified or adjusted on the basis of actual effects of known exposures as observed by industrial physicians who are on the alert to detect any effect on health in its very first stages before damage has been done.

An adequate safety factor should be maintained to protect the more susceptible person, and every effort should be made to provide conditions with the optimum of comfort, but the desirability of providing such favorable working conditions should not confuse the issue in setting up scientifically reliable and statistically significant toxic limits based not on discomfort but upon actual pathological effects.

INDUSTRIAL MEDICINE, Industrial Hygiene Section: Official Publication of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, H. H. SCHRENK, PH.D., President; J. J. BLOOMFIELD, President-Elect; EDGAR C. BARNES, Secretary; J. B. LITTLEFIELD, Treasurer: Published in January, April, July, and October: Editor, WARREN A. COOK: 605 North Michigan Avenue, Chicago.

Donald E. Cummings
1900-1942

DONALD EDDY CUMMINGS was taken from us at the height of a unique career but the work that he started will live for years to come. His influence has given nation-wide direction to industrial hygiene and affected his professional associates assembled here today and a host of executives in American industry. Wherever he went, and he was always going, his engaging personality insured him a sympathetic listener. He was "DON" and not MR. CUMMINGS the country over. His wide experience and intimate knowledge of industrial practices commanded immediate attention. His sound judgment made his opinions universally respected. This understanding of human beings and capacity for organization coupled with a boundless energy were responsible for an increasing number of successful industrial hygiene programs. The AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, of which he was one of the founders and a past president, does honor to his memory.

Unable to realize an early ambition to become a physician, DON died an associate professor of medicine, a goal that he attained by a most unusual pathway. Feeling that he could not afford the expensive training for medicine he elected a military career and graduated from the U. S. Military Academy at West Point. At the end of the World War he resigned from the Army and entered the Massachusetts Institute of Technology for post-graduate study in chemical engineering. His record there brought him an instructorship but as he was about to begin teaching, tuberculosis seemed for a time to have ruined his plans. But as so often happens, this disease proved a disguised blessing. It brought him to Saranac Lake and gave him the opportunity to come in contact with medicine.

After partially regaining his health, he taught mathematics, chemistry and physics in the local high school, to a fortunate group of boys and girls. Three years later he accepted an appointment to the staff of the Saranac Laboratory. The environment here was medical, and the work involved both research on industrial disease and clinical laboratory diagnosis. He came as a chemist but he soon acquired the techniques of bacteriology and pathology and read medical literature voraciously. He took an active part in the experimental study of the effects of inhaled dusts and their influence upon susceptibility to tuberculosis, and quickly made himself an able substitute for every member of the staff. But DON could not remain satisfied to study a disease like silicosis under laboratory conditions. It involved human beings, and he longed to observe its development in its natural setting. Consequently, when an opportunity arose to collect and study the sputum of silicotic miners in Oklahoma nothing could restrain him. At the Picher Clinic, then operated jointly by the Public Health Service, the Metropolitan Life Insurance Company and the mine owners, he laid the foundation for his real life work. Here he had a chance to study x-ray films of silicotic miners and began to perfect himself in the technique of roentgenographic interpretation. Here, as he accompanied the district nurses to the miners' homes to collect his samples, he became conscious of the social phases of industrial medicine. Here, he went underground to observe conditions in the mines, and his engineering training compelled him to think and talk of improving methods of dust prevention. Here, he obtained and performed his first autopsy on a silicotic miner in order to check the accuracy of the films taken before death.

Back to the laboratory he brought his bacteriological problems, but he now had a new point of view. He was impatient with the routine of research investigations that necessarily failed to duplicate the environment of the mines; mere animal experiments could no longer hold his attention. Consequently when the laboratory was asked to find out whether there might be a silicotic hazard in one of the iron mines in northern Wisconsin he confidently accepted the commission to investigate. Finding that silicosis existed there, before many months he had organized a program of clinical study and dust prevention that soon included all the iron mines in northern Michigan. This program has now been continued for 10 years, and has served as a model for silicosis control in many other mines throughout the country. By the now familiar combination of medical and engineering methods the dust hazard has been greatly reduced and the associated tuberculosis is under control.

But he was not content to limit his activities to this group of 40 mines, which would have been sufficient to keep most men busy. He felt that the practices of health control should also be applied in the steel mills operated by some of the mining companies, and proceeded to work for their adoption. At the same time he was making surveys of conditions in other dusty industries. All these activities were so foreign to the program of a research laboratory and yet so obviously practical and successful that a new field division of the Saranac Laboratory was created and DONALD CUMMINGS was made its director.

He was well started on his program of industrial hygiene in one of the steel mills when his tuberculosis again intervened to change his life. To avoid too intimate contact with the problems of his far-flung field program he decided to cure his disease in Denver. There he was under the care of Dr. James J. Waring, head of the department of medicine in the University of Colorado. Dr. Waring had long realized the need for industrial hygiene in the Rocky Mountain area, and he recognized that undergraduates in medicine should become familiar with the industrial origins of disease. While DON was "curing" he often discussed with Dr. Waring his many-sided views on these subjects. The outcome was the creation of a new Division of Industrial Hygiene in the Department of Medicine at the University of Colorado, with DON as its director. His title was Associate Professor of Medicine.

This appointment constituted the realization of a lifelong ambition; it provided a more intimate contact with medicine and a recognition of his contributions by this profession; it offered opportunities for teaching and the introduction of methods of health control in the mines and industries of still another section of the country. In his new capacity DON proceeded to organize his work with customary vigor. He still retained directorship of the Field Division of the Saranac Laboratory to supervise his program in the Lake Superior iron mines. He made new contacts with large industrial groups in Colorado and was soon organizing health control programs in mines, steel mills, foundries and other plants. He was an immediate success as a teacher, and made his students feel that the environment of the working place was a normal and important part of a patient's history. His experience made him the natural adviser to several of the western

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DR. LEROY U. GARDNER, long time associate of the late DONALD E. CUMMINGS, presented the foregoing tribute to his memory at the annual meeting of the AMERICAN INDUSTRIAL ASSOCIATION in Rochester, New York. Although our future meetings may include no formal verbal expression of our feelings for DON CUMMINGS, the thoughts which DR. GARDNER has put into words will be close to the surface whenever groups of us who treasured DON'S friendship get together. —WARREN A. COOK, Editor.

states that were considering occupational disease legislation, and through his influence several sound acts have been adopted.

With the advent of war he made every effort to reenter the Army, but his history of recurrent attacks of tuberculosis made him unacceptable. Debarred, he served the war production program as a civilian with no thought for his health or safety. He traveled ceaselessly to visit plants in every part of the country, and it was on the way to one of them in Nevada that a fatal airplane crash terminated his brilliant career. He died as much a victim of the war as though upon the battle field. He lived strenuously and joyously, to accomplish much in a short span of 42 years.

Governmental Industrial Hygiene Practice

—in 1942—

J. J. BLOOMFIELD,
Sanitary Engineer,
U. S. Public Health Service

LIKE many essential health services, governmental industrial hygiene practice at the Federal, state and local levels has fought an increasingly difficult battle during the first year of war. Surgeon-General Parran in January, 1942, stated that the task of the nation's health forces is to "hold the lines against preventable disease in the population sustaining the armed forces and producing the essentials of war."

Since Pearl Harbor, we on the industrial hygiene sector have had many occasions to feel that our services have been regarded as "the expendables" in this important rear-guard action. Our responsibilities have increased step by step with the titanic growth of war industry and industrial employment. They have increased also because the professions, management and labor are more than ever aware of the "essentiality" of industrial hygiene services. But the increase in the strength of our industrial hygiene force has not been commensurate with the growing responsibility.

Nevertheless, the order still stands—to hold the line. This we must do with the strength at our command, despite the difficulties that face us and the inadequacy of personnel and supplies.

As we take stock of the year's work, we shall see more clearly the problems that beset us, and perhaps shall be able to plan more efficiently to deal with them.

You will recall that as early as 1941,[1] the pattern of industrial hygiene services in wartime was cut for us in the cooperative program developed by the Division of Industrial Hygiene, National Institute of Health, and the Subcommittee on Industrial Health and Medicine of the Office of Defense Health and Welfare Services, now the Office of Community War Services. That program delegated to the Division the responsibility for: (1) the recruitment and training of personnel, (2) assistance to the War Department, (3) research, and (4) aid to state and local governmental services. I would like to summarize briefly the extent to which the field activities of this program have functioned in 1942.

Recruitment and Training of Personnel

THE recruitment and training of industrial hygiene personnel have met with many setbacks in 1942. The absorption by the military services and industry of qualified personnel has created an even more serious shortage than existed a year ago; and it is likely that the situation will not improve. Moreover, financial limitations imposed upon the Division of Industrial Hygiene by the Bureau of the Budget, as well as the "freeze" of Federal employment, have made it impossible for the Division to implement expansion of the program. The Division still maintains a staff of about 200, but replacements are becoming more and more difficult. There is no relief in sight.

Assistance to War Department

THE second phase of the program is direct assistance to the War Department in investigating health hazards in munitions plants owned by the government. To date, 69 of the 143 establishments originally certified to us for inspection have been completely surveyed, and nine have been resurveyed. Detailed reports and recommendations have been submitted to the proper authorities.

As a further step in the integration of industrial hygiene services with the Office of the Chief of Ordnance, this Division has assigned, at the request of the Secretary of War, a physician and an engineer to the headquarters of the Safety and Security Branch of the Office of Ordnance in Chicago. A medical officer has also been assigned by the Office of the Surgeon-General of the Army. These three officers are advising on industrial hygiene matters and are expediting the adoption of the best industrial hygiene practices throughout the ordnance plants.

The Division has furthermore participated in three conferences held by the Office of the Chief of Ordnance to discuss special problems in the control of hazards associated with the manufacture of munitions.

Just recently an arrangement was made between the Division of Industrial Hygiene and the Office of the Provost Marshal General whereby the state units may participate in the inspection of private war plants made by the officers of the latter agency. These officers complete an additional form on potential health hazards in the plant and submit this form with the request, if so indicated, that a further study of the plant be made by the state unit concerned.

In a directive dated March 16, 1943, the Office of the Chief of Ordnance, Safety and Security Branch, increased the scope of state industrial hygiene services. Ordnance inspectors now are canvassing commercial plants for which Safety and Security has continuing protection responsibility to determine if these plants are receiving industrial hygiene services from their state agency. If not, arrangements will be made through Ordnance and the Division of Industrial Hygiene for state or local units to inspect the plants.

Aid to States

THE Division has continued to give the states technical and administrative assistance. There are now 60 professional personnel on a lend-lease basis in 27 states. Technical assistance includes lending field and laboratory equipment, and performing various analyses of the materials of which the states sent some 700 samples last year. In addition to this type of assistance, consultation services in engineering, nursing, dentistry, and dermatology have been available.

The most significant increase in governmental industrial hygiene activities has been in the field of nursing. There are now 25 nursing consultants attached to the Divisions of industrial hygiene in 19 states. The primary objectives of the nursing program are to improve existing nursing services in industry and to stimulate the establishment of such services where they are needed. One of the most important functions of these nursing consultants is to promote part-time nursing services in small industries through the utilization of local visiting nurse associations.

From the Division of Industrial Hygiene, National Institute of Health, U. S. Public Health Service; presented at the Sixth Annual Meeting of the NATIONAL CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, Rochester, New York, May 24, 1943.

In March, 1943, the Division conducted a 10-day institute for nurses on wartime problems in industrial hygiene. Among the 70 nurses who attended were nursing consultants of the Public Health Service and state health departments, supervisors of visiting nurse associations rendering part-time industrial nursing services, and instructors from universities which offer industrial hygiene courses for nurses. The Division has also participated in numerous courses offered for industrial nurses at universities.

The nation-wide industrial nursing survey, conducted by the Committee to Study the Duties of Nurses in Industry of the Nursing Section of the American Public Health Association with the assistance of our Division, was completed. The activities of 3,027 registered graduate nurses in 911 establishments with an employment of 2,500,000 workers were covered by the survey. The Committee report[2] contains a brief summary of the findings of the survey, as well as the Advisory Group's recommendations on desirable industrial nursing practices. The analysis revealed that the three most common activities of nurses were: first, nursing care and treatment of injured and ill workers; second, assisting with physical examinations of workers; and, third, participation in plant safety activities. Activities such as home visiting and health education were not frequently reported.

The dental consultant of the Division has been active in promoting the extension of dental services in industry through state and local health departments which already have oral hygiene programs. Three state industrial hygiene divisions have added full-time dentists to their staffs, and in 26 other states, the divisions of dental health and of industrial hygiene are initiating cooperative plans for the establishment of plant dental programs.

During the past year, the engineering consultant has given advice and assistance with engineering and technical problems in 23 states. Just recently, a health education specialist has been added to our staff, and consultant services in the field of health education will soon be available.

An intensive training course in the diagnosis, prevention, and treatment of occupational dermatoses in war industries has been conducted for two groups of private physicians who are specialists in dermatology. It is hoped that these specialists will, in turn, disseminate the information to their colleagues in their communities, thus increasing the availability of consultants in industrial dermatology to war industries.

Other Activities

VARIOUS studies sponsored or undertaken by the Division have been completed or are being continued. A study on the control of exposures in the synthetic rubber and rubber processing industries engaged in war work was completed and published.[3] The preliminary report on the benzol survey was completed, and the detailed quantitative study of this and other solvents is still under way.

A study of radioactive substances in luminous dial-painting establishments has been made in Connecticut, Utah, California, and Illinois, and is now being extended to Indiana, Wisconsin, Georgia and Florida.

The tuberculosis case-finding program which the Office of Tuberculosis Control is conducting in cooperation with the Division is being continued. Seventy-seven war industries in 11 states have been surveyed by eight 35 mm. photofluorographic units operating in industry prior to February, 1943. A total of 194,896 individuals were x-rayed and 1.3% were found to have significant pulmonary tuberculosis. Approximately 60% of the cases discovered have been in the early stages most amenable to treatment.

The "Manual of Industrial Hygiene," which was prepared by the professional staff of the Division under the general editorship of Dr. Gafafer, has been published by W. B. Saunders Company, and some 2,000 copies have been distributed by the Division.

Cooperative Arrangements with War Agencies

THROUGH cooperative arrangements with other Federal agencies, such as the War Production Board, and the War Manpower Commission, it has been possible to create a tremendous interest in industrial hygiene, and to utilize the prestige of these agencies in the practical application of industrial hygiene techniques.

Last June, the six war production leaders issued a joint statement appealing to the labor-management committees in war industries to make every effort to reduce accidents and illness in the plant and in the community. About 2,000 of these committees have already been established and reports indicate that in some instances they have been instrumental in the development of health and safety programs in their plants. The Division places each Committee requesting advice on health programs in immediate contact with its state or local industrial hygiene service. The Division has also prepared an outline of a plant industrial hygiene program, urging the utilization of state and local services. A copy of the outline is sent to each committee. Many war contract plants which do not have labor-management committees have requested copies of this outline. In fact, this publication has proved to be so popular that some 15,000 mimeographed copies have been distributed. It has now been printed in pamphlet form and another 20,000 copies are disappearing rapidly.

The War Production Board has established a Section of Industrial Health, Hygiene, and Safety in the Labor Production Division for the purpose of acting as a clearing house and referral agency in the work of the several Federal agencies concerned.

These contacts with war industry should be utilized to a greater extent than in the past. We in the professions must recognize that the aroused interest of management and labor will not be channeled into real action unless we implement the interest through some old-fashioned "missionary" work.

A.M.A. Council on Industrial Health

THE Division has entered into a cooperative agreement with the Council on Industrial Health of the American Medical Association which is bringing about a closer working relationship between governmental industrial hygiene services and medical societies. The Council has fostered the formation of committees on industrial health in state and county medical societies and has outlined a program whereby local physicians are stimulated to contribute more directly to the industrial health activity in small plants.

For example, in Indiana the Committee on Industrial Health of the Indiana State Medical Association and the state committee on Procurement and Assignment Service in cooperation with the Bureau of Industrial Hygiene have conducted an emergency educational program for industrial physicians. The purpose of the program is to enable the State Committees on Procurement and Assignment and on Industrial Health to assist industry in solving its medical problems, and to train over-age physicians and those found ineligible for military service for employment in medical departments of war industries.

In Michigan, similar state committees have developed a training program for older physicians. A three-weeks' course was outlined by the staff of the Michigan Bureau of Industrial Hygiene to physicians in the

older age groups who may be called upon to serve in industrial medical departments.

Other wartime industrial health institutes have been held in California, Virginia, West Virginia, Illinois, Georgia, Oklahoma, Connecticut, and Iowa. The institutes were sponsored by the industrial health committees of state and county medical societies, universities, and other local war committees, and were given in cooperation with the state industrial hygiene units. The institutes lasted several days and were held in strategic cities of the state. The meetings have been open to physicians, management, labor, and representatives of other civic groups. It has been possible to stimulate industrial health activity through these institutes, and to bring those attending in closer touch with some of the current wartime problems.

Two medical schools—Yale and Long Island College of Medicine—have offered intensive postgraduate courses in industrial hygiene. The Division participated in these classes, which were unusually well attended.

State and Local Industrial Hygiene Activities

THE organization of industrial hygiene services has never been so extensively developed as today, although limitations in personnel and facilities control the extent of their activities.

Since the Conference met last year, new units have been established in Oregon and Washington, in Newark, New Jersey, and in New York City and Syracuse, New York. There are now 47 units in 38 states with industrial hygiene services. These units were alloted for the fiscal year 1943—a year of major war production—$1,006,000. This is only $75,000 more than was spent in the 1942 fiscal year. Altogether there are some 300 personnel, both professional and clerical, in these states. However, 21 of the 38 state organizations have staffs consisting of four or less professional personnel (including lend-lease personnel), and if shortages of trained personnel continue, it is possible that even this meager strength will not be maintained.

It is not possible to show what all of the 47 units have accomplished during a uniform period of time.[4] Thirty-five units in 29 states in 1941-42 reported investigations in 5,688 establishments employing 2,600,000 workers at the time of the plant visits. When we realize that about 12,000,000 workers were directly engaged in war production by the middle of 1942, 2,600,000 workers by comparison is small. On the other hand, the organization undertaking this work is likewise small.

Among the 2,600,000 employees, were workers who helped to attain the 1942 quota of ships, airplanes, guns and automotive vehicles, and helped to produce the machinery for radio equipment, uniforms, and other materials needed for the maintenance of the armed forces. For example, it was estimated that in the early part of 1942 some 500,000 workers were engaged in shipyards and about 700,000 in aircraft plants in the country. The 29 states alone made investigations covering 59% of all the workers thus employed in the whole country.

Experience has demonstrated that the manufacturing industries offer most of the industrial health programs. Eighty-six percent of the plants investigated by the reporting units, and 95% of the workers, were in the manufacturing industries.

The analysis further revealed that 83% of the plants receiving services were small industries—employing less than 500 workers. Only 17% employed more than 500.

Nearly 60% of the 6,000 initial investigations were of the survey type; 22% were engineering studies; 15% were predominantly medical studies and surveys; and 4% were follow-up investigations in plants which had been first visited during the previous fiscal year. In connection with the engineering studies, some 10,000 samples of air and materials were collected for analysis, and countless numbers of determinations were made in the field, such as velocity measurements, illumination readings, and ventilation measurements.

Because the program of each industrial hygiene unit is so closely allied with the war effort, much of the work was self-initiated. Over one-half, or 64%, of the initial investigations were of this type, whereas 31% were made in response to requests for service, and 5% were investigations of occupational diseases reported through an official agency, or by management.

An analysis of the sources of requests shows that industry and official labor agencies accounted for the largest proportion of requests for service. In fact, management itself made 38% of the requests, State labor departments and industrial commissions accounted for 28%, and labor unions and employees for another 10%. The remaining 24% were made by official state and local agencies, Federal agencies, insurance companies, private physicians, or by anonymous individuals.

With respect to occupational disease investigations, 15 states reported that they made 215 investigations involving 2,465 cases of occupational diseases in 191 plants employing approximately 200,000 workers. However, only five of these states reported more than 100 cases each. Conjunctivities accounted for 61%, and dermatoses for the 25% of the cases investigated.

Perhaps no other industrial hygiene activity reflects so strongly the effect of the war effort on problems needing solution in industry as the recommendations made. Recommendations for improvements in the plant health and welfare services, and in the control of potential health hazards, were made by the reporting units for 30% of the 2,600,000 workers, and reported as carried out by management for 45% of those affected.

It was significant to note that at a time when plants were converting and expanding, and new ones were being built, recommendations which involved the most workers dealt with improvement or expansion in the medical services of the plant. In fact, 47% of the workers for whom any recommendations were made, were thus affected, and for 40% of these the recommendations were complied with. The large proportion of compliances may reflect industry's recognition of the value of such services in keeping down sickness and accident rates. However, when recommendations called for expansion of present medical programs to include preplacement and particularly periodic medical examinations, these recommendations were very seldom carried out. This indicates that, although the expanding war industries are in general willing to provide the necessary emergency medical services, the rapid hiring of workers and the high labor turnover have in many instances interfered with this function of the medical service.

Recommendations for improvements in sanitation facilities were suggested to management for 31% of the workers and reported as carried out for 40% of these workers. The corresponding percentages for recommendations for personal protective measures were 25 and 10. On the other hand, a relatively small proportion of the workers (14%) were affected by recommendations made on the engineering control of air contaminants. These improvements were reported as complied with for 44% of the workers so involved, and probably would have been higher had the proper

equipment been made available. The reports show that time and time again difficulties were experienced in obtaining the necessary control equipment because of priorities, or late deliveries.

The reporting units investigated fewer plants in 1942 as compared with 1941; however, the plants visited in 1942 employed more workers. More units submitted reports in the last year, but approximately the same number of personnel carried on the field activities. It is possible that personnel disruptions, and the time involved in recruiting and training new personnel, may be reflected here. No gain was made in the investigations of occupational diseases, although more cases occurred in the plants where such investigations were made in 1942. The proportion of requests was slightly greater in the past year, and more requests for services came from the state labor departments and industrial commissions.

The most notable difference revealed by the comparison is in the amount of follow-up work on recommendations. Recommendations were made for more workers in 1942, in proportion to the total number of workers involved, but were reported as carried out for less workers. In fact, the percentage is 40 for the 1942 fiscal year, and 67 for the 1941 fiscal year. Here again wartime disruption in personnel and other difficulties are reflected. Individual reports indicate that with the personnel available, follow-up work has been curtailed in order to visit each new industry working on government contract as soon as possible.

Immediate Objectives

IN REVIEWING the year's activities, I believe that all available effort is being expended toward improving and maintaining a safe and healthful working environment in war industries.

The summary of the activities of state and local industrial hygiene units indicates that all their resources are geared to the war effort, and that their contribution, although limited, is commensurate with their resources.

Our Division has continued to take the lead in the nation-wide industrial health program, and besides furnishing practical assistance and guidance, has entered into various agreements with the war agencies in order that the nation-wide program can be completely coordinated, and more effectively carried out. The Division's own program of research, training, and technical assistance will not be expanded in the forthcoming year because of financial limitations imposed by the Bureau of the Budget, and the lack of qualified personnel.

We cannot expect additional financial support, and the reservoir of qualified personnel has long been depleted. The only alternative is more effective utilization of existing facilities and personnel, and more emphasis on those activities that relate directly to the control of occupational hazards in the plant. This means that governmental industrial hygiene services at every level must now exert even more human energy, call more upon mental and physical reserves to compensate for the present limitations. This we must do in order to continue their activities, even at their present pace.

The legal, moral, and professional responsibility for industrial health maintenance is yours and the Division of Industrial Hygiene's. Our capacities are taxed to the utmost. From now on, our performance will be measured by our ability to work together with limited resources.

Shortage of Qualified Personnel

THE critical shortage of qualified personnel can be met partially by using key personnel more effectively and by training non-technical workers for special tasks.

Professional personnel in key positions should be used to induct untrained personnel and to direct their work, as well as to strengthen working relationships with community agencies concerned with health matters. This type of "up-grading" has been most successful in war industry, with a corresponding increase in production. Retaining experienced workers for the larger administrative tasks makes it possible to reach a larger number of plants with a greater variety of services. For example, key personnel can integrate the industrial hygiene service with the programs of other community health agencies by making the necessary contacts for industry, promoting the various phases of health programs, and utilizing the various state and local committees that are showing interest in the health of workers in war industries.

For example, more effective use can be made of the labor-management committees in directing their efforts towards the reduction of illness and accidents in the plant and in the community.

Many units have already collaborated to their mutual benefit with the state medical committees on industrial health affiliated with the Council on Industrial Health of the Ameircan Medical Association. These committees are developing industrial health programs, setting up standards for medical practice in industry, and sponsoring emergency educational institutes in industrial hygiene.

The utmost advantage should be taken of the arrangement between the Division of Industrial Hygiene and the Office of the Provost Marshal General concerning the inspection of private war plants. Such inspections can eliminate the need for the state and local industrial hygiene units to make inspections of all war plants by using the results of the inspections of these officers, and making technical studies of potential hazards only when indicated.

We must begin now to plan for the introduction of non-technical personnel into industrial hygiene services, in order to meet the shortage of trained workers. I do not mean that we shall expect laymen to undertake professional work. But throughout the public health program, in medicine, nursing, industry, and commerce, the war economy is forcing us to conserve our professional skills by assigning specific, routine tasks to untrained people for whom intensive training in particular duties and professional supervision is provided.

We are all familiar with the work of nurses' aides in the hospitals and health centers. The venereal disease control divisions of several state health departments, notably in North Carolina, are using lay workers in an intensive case-finding program. School teachers, salesmen, clerical workers, and the like have been recruited in North Carolina and given a three weeks' orientation course to familiarize them with the objectives of the program and the technique of case-finding. They are doing a remarkably successful job.

I strongly urge each unit director to consider with his staff the types of jobs in the industrial hygiene program which could be done by such a group of specially trained and supervised workers. Undoubtedly, much professional leg-work could be saved by such personnel in preliminary inspections and in taking samples.

It is up to the units to comb the states for personnel not eligible for military service—men in the older age groups or with disqualifying physical defects. This is particularly important if the division is thinking of decentralizing the program to strategic areas in order to streamline its service to industry. With careful training, with supervision that prevents emergency

personnel from undertaking too much, this untapped reservoir of industrial hygiene manpower should prove an invaluable lift.

First Things First

OUR traditional sphere of service is the control of occupational disease. It is on the basis of work well done in this service that the concept of industrial hygiene has broadened in the past few years to include the concept of adult health. This growth is right and proper, and is the inevitable objective of our work. The problems of the present war, however, have made it increasingly difficult for the governmental industrial hygienist to render a complete service without detracting from one or more of his functions. Moreover, many national and local campaigns have brought heavy pressure to bear upon the industrial hygiene services to participate actively in specialized programs aimed at the war workers.

The industrial hygienist should not permit his program to smack of "specialization," for our profession is not a specialty in occupational disease alone, nor yet is it a specialty in nutrition. We are in some danger of over-emphasis upon certain phases of our program at this time, especially because of the rapid introduction of new personnel into industrial medicine and governmental industrial hygiene services. For example, an industrial hygiene unit can become keenly interested in a program for nutrition in industry—a highly desirable interest—to the neglect of exposures to mechanical and chemical hazards.

The industrial hygienist's first and most important responsibility is to establish and maintain a safe and healthful working environment. His first and most important duty is the reduction of industrial disability in its strictest meaning. There is not a single industrial hygiene unit that can claim to have carried out this responsibiilty to so great a perfection that it can branch away from this objective and actively undertake tuberculosis control, venereal disease control, or nutrition work in the plant as some are doing.

A few years ago we defined industrial hygiene as adult health. The fact was stressed that the non-occupational disabilities accounted for nine-tenths of the absences from work, and that by integrating the industrial hygiene activities with other health services in a health department, a complete public health program can be brought directly to industry in the interest of reducing some of this lost time. This fact is still true. The industrial hygienest should be interested in all phases of adult health work, but his activities should be limited to referring the plant to the proper agency, making the contact for the plant with the agency, and counseling. This does not mean that the industrial hygiene personnel should go into the plant and undertake the actual solution of the problem—in other words, do all the adult health work of a health department.

The present war effort has indicated strikingly the urgent need for the technical services that the industrial hygiene unit alone can offer. There is no other agency so trained and so equipped for rendering this type of service.

Now that jobs and wages are frozen, workers are growing more and more insistent on having healthful and safe working conditions. They have, in several instances, threatened to strike if correction of adverse conditions was not effected. Furthermore, the Army, the Navy, the Maritime Commission are looking to us for help in the control of occupational hazards in plants which they operate, and much of the technical assistance that this requires has to be rendered by the state and local industrial hygiene units.

For the present, while trained and qualified industrial hygiene personnel are at a premium, every unit must put first things first. And in this field, that means the control of occupational hazards. Open the doors for the venereal disease control program. Open the doors for the tuberculosis association, the visting nurses, and the nutrition committees. Help the plants and unions that turn to you with good counsel and thoughtful referrals. But do not try to be "all things to all men." There are no Saint Pauls in our profession as yet.

The coming year will put to the ultimate proof the work of the industrial hygiene services. Only by hewing to the line, by complete use of every available resource, and by teamwork of an order even higher than we have yet achieved in our years of cordial cooperation, shall we meet that test.

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Industrial Hygiene

—In Synthetic Rubber Manufacture—

F. S. MALLETTE,
The Firestone Tire & Rubber Co.,
Akron, Ohio

TODAY, the vital importance of the synthetic rubber industry in the national economy is a matter of common knowledge. Upon the production of this material depend the needs of our armed forces and the future of civilian transportation. With 90% of our normal import of 600,000 long tons of natural rubber cut off, the magnitude of our present-day need is apparent. In the words of the Baruch Committee ". . . unless adequate new supplies—natural or artificial—can be obtained in time, the total military and export requirements alone will exhaust our crude rubber stocks before the end of next summer (1943)."

The demand for synthetic rubber this year has set a high goal. By the end of 1943, the synthetic rubber industry should be producing at the rate of 432,000 long tons, and an ultimate goal of production of 813,000 long tons should be reached some time in 1944.[1] In an industry expanding at such a miraculous rate, there lies a golden opportunity for the conserving forces of industrial hygiene.

Buna S

OF THE FOUR different types of synthetic rubber called for in the present government program, Buna-S is most important and will be produced in the greatest volume. This substance most closely resembles natural rubber and will replace it for general purposes. Its processing has been recently greatly improved. The Germans, who first developed this synthetic, coined the name "Buna" from the first two letters of butadiene, one of the main ingredients, and Na, the chemical symbol for sodium, formerly used as a catalyst. In this country, the government program Buna S is to be known by the letters GR-S. Other Buna types may be more familiar by their trade names of Butaprene, Chemigum, Hycar, Perbunan, and Synthal.

Before beginning a discussion of the potential health

Presented at the Fifth Annual Meeting of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, Rochester, New York, May 25, 1943. Part of this material was also presented at the 14th Annual All Ohio Safety Congress, Columbus, April 21, 1943.

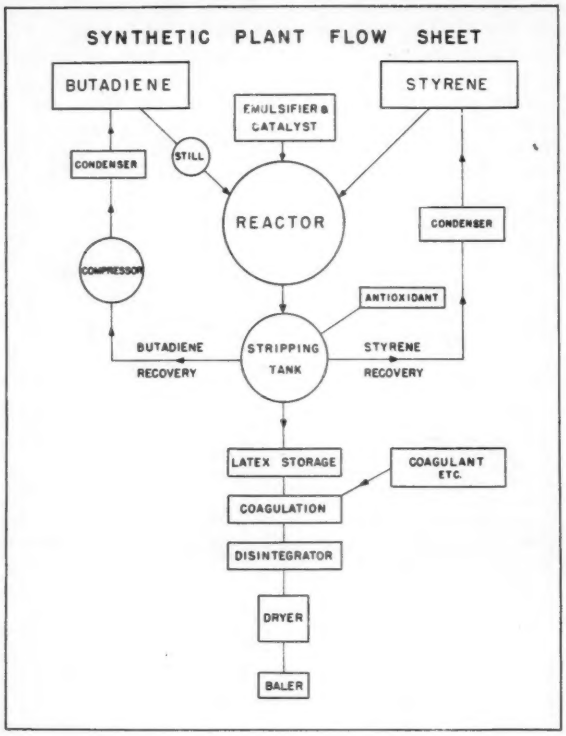
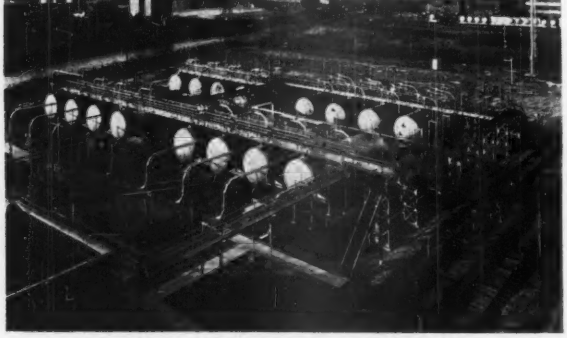


Fig. 1

hazards of synthetic rubber manufacture, a description of the process itself would seem to be in order. It is shown diagrammatically in Fig. 1. The two basic ingredients, butadiene and styrene, used in the synthesis of GR-S, are represented by the two boxes at the top. From here, the butadiene and styrene, after having the inhibitor removed, are weighed and pumped into the reactors which are large jacketed autoclaves. Other materials are also added at this time: the emulsifying agent, the catalyst, the modifier, and other substances necessary to regulate the polymerization or the characteristics of the final product. The polymerization process is carried out at an elevated temperature under pressure, takes a number of hours to complete, and results in the formation of a white, milky fluid which closely resembles natural latex.

Next, the synthetic latex is pumped into the stripping tank, to which the antioxidant has previously been added, and the unreacted butadiene and styrene are recovered to be used again. The synthetic latex is then stored, and later blended to produce a uniform product.



Butadiene and styrene storage tank farm

For the next step, the latex is mixed with the coagulating solution and changes from a milky fluid to a sticky, resilient mass which is next disintegrated, spread on the wide belt of the dryer, and most of the moisture removed. The resulting material may be sheeted, pressed into sheets, or processed into any convenient form for further use.

In the manufacture of oil-resistant or specialties synthetic rubber, also known as Buna N, essentially the same process is used, but one of the main ingredients, styrene, is replaced with acrylonitrile (vinyl cyanide). The resulting product is a dense, relatively non-porous material which does not swell appreciably in gasoline, lubricating oils, alcohol, or other solvent liquids, and is especially well suited for use in mechanical goods, where oil resistance is of prime importance.

From the point of view of potential health hazard, the problem is considerably minimized by the fact that much of the synthetic process is carried out in a closed system. This serves the happy purpose of preventing exposure to more than exceedingly low concentrations of the materials used. However, in the event of a serious leak, there might then be exposure to fairly high concentrations, and so it might be well to consider their effects in this discussion.

It was indeed fortunate that foresighted research had already been begun on the toxicology of butadiene, styrene, and acrylonitrile before their extensive use in the synthetic rubber industry. This is a prime example of what can be accomplished by the preventive aspects of industrial hygiene. A thorough study of butadiene has almost been completed, and the results have been abstracted in a recent government memorandum.[2] Publications have already appeared on styrene and acrylonitrile, [3, 4, 5] and will be summarized here.

Butadiene

BUTADIENE (vinyl ethylene) is a gas at ordinary temperatures, for it boils at -5° C. For this reason, it is always kept under pressure to avoid loss. Thus it is unlikely, under normal conditions, that there will be exposure to more than very low concentrations. From preliminary reports of animal experiments and from human exposures in our synthetic rubber laboratory, it appears that there is little or no cumulative effect from repeated inhalation of low concentrations of butadiene. So far as single accidental exposures are concerned, if the concentration is well below the lower explosive limit (2.2%, or 22,000 parts per million), there should be no permanent effect. Butadiene seems to be only mildly narcotic in concentrations below the lower explosive limit. Coupled with these facts is the characteristic odor of butadiene which gives adequate warning of its presence, even in low concentration.

It is also reported that animal experiments disclosed that irritation of the eyes, nose and respiratory tract was produced by exposure to butadiene vapors. In those animals which died after exposure, the cause was found to be either pulmonary edema or pneumonia. However, no irritation which could be attributed to butadiene vapors has been noted in our synthetic plant or even in our experimental laboratory, where occasional fairly high concentrations result from a crude distillation process.

In the modern synthetic rubber process, there is normally no exposure to more than minute amounts of butadiene. Uncombined butadiene is recovered almost 100% at the stripping tank. However, if there is ever any appreciable amount of unrecovered butadiene in the latex, it would be freed, because of its

volatility, when the coagulation process took place. Fairly high concentrations could exist before any physiological effects would be observed.

Styrene

MONOMERIC styrene (vinyl benzene) is a colorless liquid, with a boiling point of 145° C. Its gassy odor should provide ample warning of toxic concentration. Furthermore, it does not seem to produce the blood damage so characteristic of benzol which styrene closely resembles in structure. In a series of several hundred periodic blood examinations of workers in both Buna S and Buna N type plants, no damage traceable to any of the materials used in the synthesis of rubber has ever been found. Nutritional anemia, however, seems to be widespread among the present-day industrial population, and care must be taken not to confuse this with the effect of exposure to organic compounds.

The principal action of styrene seems to be that of irritation of the lungs upon inhalation, and of the skin upon contact. Also to be considered, however, is the fact that light narcosis may be produced by inhaling small amounts of styrene, as with the other aromatic hydrocarbons. Following exposure to high concentrations of styrene, with accompanying respiratory tract irritation, there may also be liver and kidney damage. The eye and nose irritation produced by styrene serves as a warning against acutely hazardous concentrations. As a result of animal experimentation, a tentative permissable limit of 400 parts per million has been suggested. There is a possibility that this limit may be too high to prevent skin irritation in synthetic plant workers. A recent publication of the Rubber Reserve Company[2] gives 200 parts per million as a preferable figure. At this concentration, a disagreeable odor is present, but eye and nose irritation should not be produced. It is believed that no serious health hazard should result in the case of repeated exposures to this concentration.

With present equipment, appreciable amounts of styrene vapors are not freed until late in the synthetic rubber process, when the latex, which contains a certain amount of unrecovered styrene, is coagulated in an open system. The largest portion of the residual styrene is vaporized by the dryer with its elevated temperature. Also driven off at this point may be small amounts of an aromatic hydrocarbon, used as a softener or dispersing agent for the antioxidant, together with small amounts of antioxidant itself, free fatty acid, and of the low polymers. Extreme care must be taken to control these vapors, as they are quite irritating to the eyes, respiratory tract and skin. This can best be done by maintaining a slight negative pressure within the dryer, by means of its exhaust system. Should this interfere with the drying process, exhaust hoods must be installed at the dryer outlets, where most of the vapors escape.

Acrylonitrile

AS MENTIONED previously, in the preparation of Buna N, the oil-resistant rubber, the process is essentially the same, but instead of styrene, acrylonitrile (vinyl cyanide) is used.

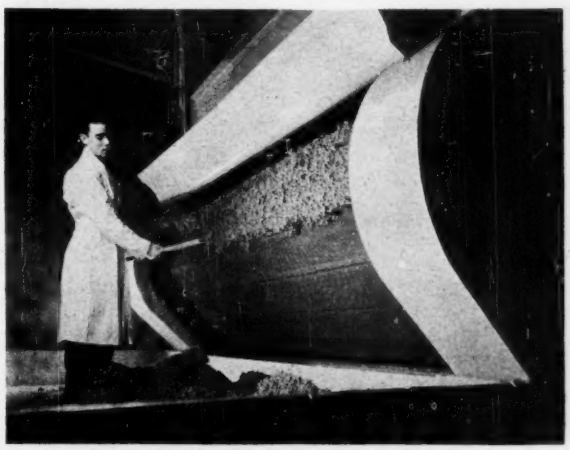
This substance is a colorless, volatile liquid, boiling at 76° C, and having an ethereal, but not unpleasant odor. Other characteristics are its flash point, which is 4°C, and the inflammable limits which are 3.05% and 17%.[5] The effect on laboratory animals of single and repeated exposures to the vapors of acrylonitrile has been studied by Neal and his associates at the National Institute of Health. The conclusion reached, as a result of these studies, is that acrylonitrile is a toxic compound, comparable to a molecular equivalent

Synthetic latex blending and storage tanks

of hydrocyanic acid, and a maximum permissible concentration of 20 parts per million in air has been suggested. This figure represents approximately one-half that concentration which has produced a toxic effect in dogs, the most susceptible species yet studied.

There are a number of potential exposures to acrylonitrile in the present-day Buna N process. Delivery of this material is made either in drums or tank cars. In the latter case, there should not be any appreciable exposure to vapors because the pumping is done entirely through a closed system. With the acrylonitrile in drums, however, there is considerable chance for exposure. Spillage, leaky pumps, and escape of vapors are sources of hazard.

The measuring of ingredients and the polymerization process proper is carried on within an enclosed system, and normally no vapor should escape. In the present process, however, no effort is made to recover unreacted acrylonitrile, so that from the polymerization process on there is opportunity for exposure to this compound, both in the liquid and vapor phase.



Finished rubber emerging from dryer

Slabs of baled synthetic rubber

The coagulation process also differs in that smaller particles are obtained, so that dewatering must be accomplished by centrifugation or filtration. These operations may be the source of considerable amounts of acrylonitrile vapors. Enclosure of the centrifuges or filters as far as possible, and application of local and exhaust ventilation is essential. The coagulation process and the storage of crumbs are sometimes carried out in semi-enclosed tanks, from which vapors may escape, unless ventilation is provided. In the early days of synthetic rubber production, batches were tested for yield by the worker squeezing the material with his bare hands. This provided a dangerous opportunity for skin absorption. This crude and hazardous method has now been replaced by the use of a hand press which not only provides a more efficient test method, but also eliminates the health hazard.

As in the Buna S process, the greatest potential source of vapors is the dryer. The same remarks which were made for styrene apply here, but even greater precautions must be taken for acrylonitrile is many times more toxic than styrene.

Local exhaust ventilation hoods over dryer outlets

Workers assigned to cleaning out reactors in both the S and N type plants must receive approved protection for work of this kind. It is safe practice to provide complete suits of an impervious material, rubber boots and gloves, a U. S. Bureau of Mines approved air-supplied mask, and a life-line with watcher outside the tank. Before the worker is permitted to enter the tank, the interior should be blown out with steam for not less than four hours to remove as much of the residual vapors as possible. For reactors in N type plants, a preferable practice is to purge the interiors of the reactors with boiling water to remove acrylonitrile before the man enters.

The explosive character of the vapors which may be present in latex storage tanks requires that they be purged with an inert gas composed of almost pure nitrogen. Care must be taken to prevent the exclusion of oxygen by this inert gas. Anoxia may occur in the worker assigned to check the filling of tanks, as he peers into the top vent from which the inert gas is rushing, displaced by the latex flowing in from below.

Detection and Determination

BOTH butadiene and styrene, in low concentrations, may be determined by a commercial benzol indicator.[8] This instrument can be readily calibrated for these vapors. For higher concentrations, the explosimeter or combustible gas indicator is effective. A combustible gas alarm is advisable for the permanent protection of areas such as pump houses, storage depots, etc., where vapors might accumulate.

There is, unfortunately, no practical method or instrument yet available for the detection and determination of acrylonitrile. In laboratory experiments, the interferometer has been used, but even this instrument will not determine concentrations which are dangerously above the maximum permissible limit. The characteristic odor of acrylonitrile serves as a useful warning property, but care must be observed here, as the olfactory sense is quickly fatigued and little reliance can be placed upon it except for first impressions.

Workers potentially exposed to the vapors of acrylonitrile may be checked for over-absorption by means of the analysis of blood and urine specimens.[7] Following exposure to acrylonitrile (or other nitriles), determination of thiocyanate in the blood and urine provides a useful index of the degree of exposure. Care must be taken, however, in the interpretation of analytical results to allow for the effect of smoking which also increases the blood and urine thiocyanate content. Only values in excess of 3 milligrams percent or more of serum thiocyanate and 16 milligrams per 24 hours of urinary thiocyanate indicate over-absorption of acrylonitrile in smokers, while the corresponding values for proved non-smokers are 2 milligrams percent and 2 milligrams per 24 hours.

Serum thiocyanate values are at their maximum immediately following exposure to acrylonitrile, so that blood specimens should be taken at the end of the working period. Urinary thiocyanate values reach a peak 24 to 48 hours following exposure, so random samples may be utilized, although a portion of a 24-hour specimen is preferable.

This test has been found to be very useful in detecting excessive exposure to acrylonitrile. Table 1 shows values determined for workers in our Butaprene plant, together with the operations on which the men were employed. By correlation of the results and the operations, control measures have been applied which evidently reduced the concentration of acrylonitrile in the

air. These analyses, which cover a period of six months, were made by the Division of Industrial Hygiene of the National Institute of Health, and show a progressive reduction in almost every instance.

Summary

THE vital importance and rapid expansion of the synthetic rubber industry provides an excellent opportunity for industrial hygiene activities. Of the four different types of synthetic rubber called for in the government program, Buna S is to be the most important and will be produced in the largest quantity. The almost complete enclosure of this process prevents exposure to all but low concentrations of vapor. Butadiene appears to be fairly safe in concentrations below the lower explosive limit (22,000 parts per million). Styrene is important because of possible irritation of the skin, eyes and respiratory tract. Extensive animal exposures to vapors of styrene resulted in a tentative permissible limit of 400 parts per million which may safely and practically be reduced to 200 parts per million, as the result of more recent experience. Acrylonitrile, used in the production of Buna S type oil-resistant rubber, is a toxic compound and exposure to it must be prevented. A permissible limit of 20 parts per million, based on animal experiments, has been published.

In a series of several hundred blood examinations, no effect traceable to butadiene, styrene, or acrylonitrile could be found.

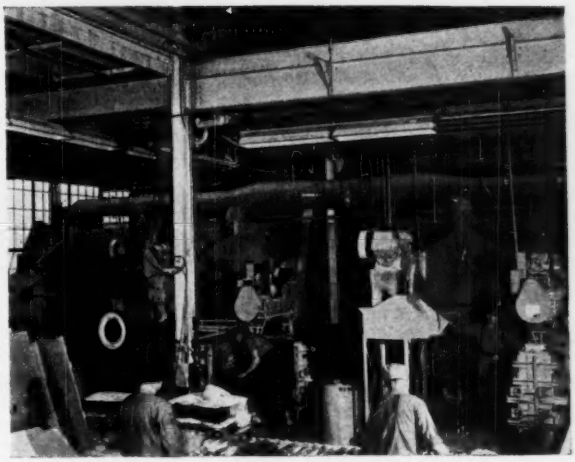
The points of potential exposure in these processes are in the handling of raw materials, coagulation, centrifugation and drying. The benzol indicator is the most practical method of determination of low concentrations of butadiene and styrene. No method being available for the determination of acrylonitrile, a useful procedure is to test the blood and urine for thiocyanate content.

Adequate local and general exhaust ventilation must be provided for coagulating tanks and centrifuges. The escape of vapor from the dryers can best be prevented by maintaining a slight negative pressure within them. It may be necessary to provide hoods over the dryer outlets to control vapors of styrene and other substances driven off at this point.

CORRELATION OF OPERATION WITH SERUM & URINARY THIOCYANATE CONTENT

OPERATION	SMOKER	THIOCYANATE			
		SERUM MG. %	SIG.	URINARY MG. L.	SIG.
HEAD OPERATOR	YES	1.94	NO	14.2	NO
ASSISTANT OPERATOR	NO	2.34	YES	53.2	YES
	YES	2.81	NO	23.6	YES
	YES	1.59	NO	8.8	NO
	NO	—	—	12.5	YES
SOLUTION PREPARATION	YES	0.98	NO	3.7	NO
SALT COAGULATION	YES	2.94	NO	35.0	YES
	YES	1.19	NO	8.6	NO
	YES	1.03	NO	3.84	NO
CENTRIFUGE	YES	1.16	NO	21.1	YES
	YES	1.69	NO	17.2	NO
	YES	3.47	YES	8.6	NO
DRYER	YES	3.05	NO	58.2	YES
	YES	1.94	NO	41.2	YES
	YES	0.69	NO	8.9	NO
	YES	2.48	NO	13.7	NO
	YES	1.44	NO	8.8	NO
	YES	—	—	25.0	YES
MILL	YES	1.38	NO	7.9	NO
BALING	YES	1.13	NO	7.68	NO
	YES	0.91	NO	17.4	NO
	YES	—	—	7.0	NO
SHIPPING	YES	2.09	NO	8.3	NO
UTILITY	YES	2.97	NO	25.3	YES
	YES	0.43	NO	6.4	NO
	YES	0.53	NO	3.12	NO
TANK CLEANUP	YES	1.78	NO	37.4	YES
	YES	—	—	16.0	NO
NORMAL VALUES	YES	3.0		6.0-200	
	NO	1.5- 2.0		2.0	

Table I.



Local exhaust ventilation hoods over dryer outlets (close-up)

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Worker descending into stripping tank for cleaning out interior

Administrative and Working Relationships

—Between the Georgia Industrial Hygiene Service and the United States Maritime Commission—

LESTER M. PETRIE, M.D.,
Director, Industrial Hygiene Service,
Georgia Department of Public Health

THERE are five shipyards in Georgia. A preliminary investigation in the spring of 1942 revealed that three of these yards were in the early construction stage. Officials of each yard were contacted, and the broad outlines of an over-all industrial health program were discussed. The services recommended for an effective program were outlined at that time as follows:

1. Pre-employment and periodic physical examinations of all personnel, including executives. Record forms adapted from forms successfully used elsewhere were presented as models.

2. Tuberculosis, venereal diseases, and other communicable diseases should be found and controlled in cooperation with the local health department. All workers should be protected by immunization against smallpox, typhoid and tetanus.

3. Prevention and treatment of accidents, including preparation for emergency treatment of casualties resulting from bombing attacks or sabotage.

4. Determination and control of sanitary and occupational hazards.

5. Absenteeism records from which rates can be calculated by color, sex, age, occupation and cause. A simple record card wihch will supply this information was demonstrated. These records are adaptable to punch cards.

6. Nursing follow-up of all absenteeism from illness in cooperation with the local health department and nurses.

7. A nutrition program including company owned and operated cafeterias and canteens on non-profit and non-loss basis, and cooperation with the National Nutrition Council's program.

8. Health education through talks, movies, pamphlets, demonstrations, etc.

9. Rehabilitation service. Suitably trained cripples make reliable workers and become more stable employees than the so-called "physically perfect" group.[1]

In addition, specific arguments and recommendations were made for discovery, prevention and control of occupational diseases, tuberculosis, veneral diseases and nutritional deficiences. These illnesses were selected for specific mention because they are not only of high rank as causes of morbidity and mortality, but are also preventable by proved techniques.

ONE of our larger yards accepted these recommendations and employed a full time medical director from the beginning. With his assistance a comprehensive and most excellent health and safety program was planned even before production was started, and has since developed very satisfactorily. Just outside the yard entrance they built an employment office with adjoining medical examination rooms for pre-placement physical examinations on all applicants. Inside the yard, they built and equipped an excellent dispensary with offices for doctors, safety engineer, etc. In the dispensary building they included space for treatment of venereal disease. No applicants are refused employment because of venereal disease except those who refuse treatment and those who are in late disabling stages. The actual venereal disease control program is administered by the local health department. A chest x-ray survey of all employees was made using the equipment of the Georgia Department of Public Health. An in-plant feeding program was also provided, including a cafeteria and several canteens at strategic locations.

The management at another of the largest Georgia yards, which was also under construction at that time, appeared to feel that the responsibility for the initiation of an industrial health program rested with the Maritime Commission, and that the responsibility for administration should be assumed by the insurance carrier. They felt that preplacement physical examinations would hinder them in securing new employees as rapidly as needed for the great expansion of their new industry, but stated their willingness to attempt such a plan if specifically requested to do so by the Maritime Commission. Assistance of the State Health Department in the recommended physical examination program was offered them, through a chest x-ray survey of all employees and use of the facilities of the state laboratories for performance of Kahn tests.

The medical department at that time consisted of several nurses without medical supervision on the yard, housed in a temporary three-room building with inadequate equipment and limited sanitation. Cases requiring a doctor were referred to the insurance physician in town. No provision was contemplated at that time for a full time physician on the yard, nor for the construction of adequate dispensary facilities. In the report of our preliminary survey of this yard, it was pointed out that in a yard of this size a full time medical director actually working in the yard would become increasingly more necessary. A physician spending no time in the yard could have little conception of the many problems arising in connection with the work, and consequently could not direct the medical department adequately.

The regional claims manager of the insurance carrier was contacted,[2] and the principal features of this broad industrial health program were outlined to him. He appeared to be greatly impressed with the potential possibilities of such a plan, and expressed the hope that such an industrial health program including preventive medicine could be developed raher than, as he put it, "a piddling program" limited to safety and compensation work. Insurance companies, however, have not developed a policy of this nature, so he had no basis on which to offer complete medical coverage. He suggested that we prepare a written plan of this overall program, discuss it with the New York office of the company, and also submit it to the Maritime Commission. It seemed that the only hope for establishment of the program in this Georgia maritime yard was to have it approved in Washington. This meant that promotion of minimum health standards for maritime shipyards on a nation-wide basis as a general requirement of the Maritime Commission seemed to be indicated.

The proposed industrial health program was written up,[3] incorporating the broad outline previously mentioned. Sample forms for physical examinations and sickness absenteeism records, and a suggested budget were included. It was recommended that the insurance carrier should be responsible for a part of the budget, proportional to the amount of insurance company work done by the medical department.

The plan was discussed in New York with the insurance company officials.[4] They did not commit themselves to the program, but did express interest in it and a willingness to consider the development of a comprehensive industrial health program, and to administer it for the shipyards, provided the Maritime Commission should specifically request it.

Presented at the Sixth Annual Meeting of the NATIONAL CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, Rochester, New York, May 24, 1943.

The proposal was discussed with a representative of the Maritime Commission in Washington.[5] His opinion was that the arguments for the proposal were sound, but that the Maritime Commission would need the advice of authorities in the field of industrial health as to the economic soundness of the plan from an actual working standpoint. Extra copies of the plan were given to the Maritime Commission for appraisal by authorities of their choice. Generally favorable opinions were expressed by Dr. Clarence D. Selby, of General Motors, Professor Phillip Drinker, of Harvard, and Dr. J. G. Townsend, of the National Institute of Health.[6]

THROUGH collaboration of the Navy and the Maritime Commission, a survey of shipyards throughout the United States was conducted by experts in industrial health and safety assigned to the Maritime Commission.[7] A manual of minimum health standards was unanimously agreed upon at a national conference under the auspices of the Navy and the Maritime Commission, held in Chicago on December 7 and 8, 1942.[8] This manual received final approval of the Navy on January 20, 1943, and of the Maritime Commission, February 9, 1943.

The Health Control Division, established in the Division of Shipyard Labor Relations of the Maritime Commission, is under Consultant Directors Philip Drinker (health consultant) and John M. Roche (safety consultant). Mr. Roche has a staff of four full time men, one in each regional district. Professor Drinker has two industrial hygienists and a doctor on the Atlantic coast, the same on the west coast, one industrial hygienist in the Gulf Area, and one industrial hygienist in the Great Lakes Area.[9] These men are all commissioned officers of the Navy. In the Gulf Coast Area where the Maritime Commission has only one industrial hygienist, a physician attached to the District Office of the U. S. Public Health Service has served as a consultant when called upon to do so.

Industrial hygiene services in all of our Georgia shipyards are now under the supervision of the Health Control Division for the Atlantic Coast, directed by Dr. H. K. Sessions, with headquarters in Philadelphia. On January 27, 1943, a conference was held in Brunswick, Georgia, attended by Dr. Sessions and his staff, Professor Drinker, and representatives of the Industrial Hygiene Service of the Georgia Department of Public Health. Working relationships, mutually acceptable to both organizations, were arranged. The personnel and equipment of the Industrial Hygiene Service of the Georgia Department of Public Health were made available to the Maritime Commission for use in the Georgia yards.[10]

The plan works as follows: (1) Copies of previous survey reports, recommendations and pertinent correspondence affecting the Georgia shipyards are filed with both organizations. (2) Joint shipyard surveys are made, utilizing our combined resources. (3) Reports of the Industrial Hygiene Service of the Georgia Department of Public Health are submitted to the Health Section of the Maritime Commission for review to avoid conflicting opinion. Similarly, copies of reports prepared by the Health Section of the Maritime Commission are filed with the Georgia Department of Public Health. (4) Reports are delivered to the yards personally by representatives of one or preferably both organizations, and are discussed point by point with the proper authorities in the yards; or the reports are mailed to the yard, and a follow-up visit within a few days for a personal discussion is arranged. (5) Follow-up surveys are made. These are made jointly by representatives of both departments in so far as time will permit, but either department is free to contact the yards individually at any time with the agreement that the other organizations will be kept informed of significant developments.

The reports give specific recommendations for initiating or improving the control of any hazardous operation or environmental factor which has been observed. Recommendations are not limited to the minimum health requirements of the manual. Included are detailed studies of all departments and all operations carried out in the yard, along with quantitative examinations of any samples that might be indicated. Attention is called to any health hazard observed or to any suggested procedure which may be reasonably expected to pay dividends in increased productive capacity per worker.

Since the above agreement was reached, joint surveys have been made of all five Georgia yards, and reports and recommendations have been submitted. Further yard studies being made at the present time show that many of the recommendations are being followed. Advantages of the joint working relationship include the pooling of our resources, the avoidance of duplication of effort and the elimination of conflicting findings or recommendations.

ONE of the greatest problems of successful application of the program is the procurement by the yards of qualified trained personnel who are capable of applying present day knowledge. The value of the facts concerning hazards which are discovered by surveys may be limited in accordance with the skill and ingenuity employed in correction. It offers a great challenge as well as opportunity especially to physicians, engineers, chemists, nurses, and administrators.

The authority of the director of the program is another problem also worthy of special mention. The medical director should be a well qualified physician and he should have supreme authority in the plant in matters pertaining to the health of employees. He should be directly responsible to the highest executive in the plant and not subject to interference in medical matters from lower ranking officials. We believe this to be a better arrangement than having him responsible to an independent organization such as the insurance carrier. Similarly, the safety engineer should be qualified, and compliance with his recommendations as to control equipment and engineering design for health protection should be mandatory.

As mentioned previously, the management of one of our largest yards expressed the opinion early in the game that pre-placement physical examinations were impractical because of the time element. The importance of this factor is readily apparent. Within the past two years the number of shipyard employees in Georgia has jumped from only a few hundred to about 33,000. In the yard which developed the complete program from the beginning there are now between 12,000 and 13,000 employees. With three full time physicians they have kept their program up to date. One of the physicians spends his full time doing physical examinations. With the aid of two nurses and two clerks, he was able to examine 3,438 applicants during the month of April, 1943, the highest daily total being 196.[11]

Applicants are classified as follows:

Class 1—No defects.

Class 2—Minor physical defects present but applicant physically able to do any work on the yard.

Class 3—Major physical defects but applicant physically qualified for some particular job. His record must be reviewed by the examining physician before he can be transferred to any other work.

Class 4—Physically unable to perform any work on the yard.

The examining physician then checks the employ-

ment slip for the job for which the applicant is slated, and if he finds that it does not fit the applicant's physical qualifications, he contacts the interviewer who made the assignment and a change is worked out. Criteria for placement have been established by the medical director, who first learned as much as he could about what each job in the yard entailed and then outlined the physical requirements with the aid of the heads of the various departments concerned, the safety director and the personnel director. The examining physician spends one afternoon a week on the yard familiarizing himself with operations and checking up on the performance of handicapped individuals.

The results of 12,784 preplacement examinations have been tabulated as follows:

Total number of pre-employment examinations	12,784	
Number in Classes 1 and 2	11,987	or 93.8%
Number in Class 3	716	or 5.6%
Number in Class 4	81	or 0.6%
The number of Class 4 cases in the last 3,483 exams	14	or 0.4%

It has been said that we know enough to make every job safe, healthful and more productive. Our problem is to apply this knowledge. The working relationship between the Georgia Department of Public Health and the Maritime Commission has been developed as a tool. We believe it to be a useful implement for better conservation of the lives and health of our shipyard workers. The way it has worked is evidence of accomplishments which can be anticipated from coordination of efforts of all agencies concerned such as the Maritime Commission, the U. S. Public Health Service, the Labor Department, the Food Distribution Administration, and the State Health Department. The Georgia Department of Public Health welcomes the assistance and cooperation of all federal and other related agencies in carrying out a comprehensive industrial health program in all of the war industries of our state.

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American Industrial Hygiene Association
News of Local Sections

Metropolitan New York Section

MEETINGS of this section were held on May 19 and June 16. At the former meeting, Dr. Eugene F. DuBois, Professor of Physiology, Cornell University Medical College discussed the subject "The Effects of Extreme Heat and Humidity on Work Capacity." Dr. DuBois demonstrated the human calorimeter and other instruments which give precise measurements of body temperature and radiation. He discussed internal temperature zones between 36-45° C, with a secondary heat regulatory mechanism beginning at 40.5°C. He pointed out factors which influence internal temperature as derived from his experiments on many human subjects. The human body gives off heat in the infrared region. The human skin is a nearly perfect absorber, therefore radiation experiments are accurate for skin temperature. The environmental factors which make up the comfort zone were explained, and it was stressed that there is no one body temperature, for wide variations occur in rectal, mouth, skin, hand, feet and head temperatures. The blood flow in the skin is a secondary regulation control mechanism. Dr. DuBois also stated that in moist hot atmospheres body heat production increases, but that body heat loss cannot increase, therefore a high storage of heat results which predisposes heat cases. These basic factors on the effects of extreme heat and humidity are valuable information relative to industrial workers in high external temperature environments.

At the June meeting Dr. A. G. Cranch and Mr. F. A. Patty reviewed the Annual Meeting of the Association held in Rochester.

Michigan Section

THE Sixth Annual Meeting of the Michigan Industrial Hygiene Society was held on June 2 in Detroit. Following the business meeting a number of industrial hygiene subjects were presented.

"Fluoride Exposures in Industry" were discussed by Gordon C. Harrold, Ph.D., Industrial Hygienist, Industrial Hygiene Laboratories, Chrysler Corporation. The observations of the Chrysler Industrial Hygiene Laboratories were given together with a report of material presented on this subject at the Rochester Conference of the American Industrial Hygiene Association.

"Review of Health Hazards of Common Industrial Solvents" was the subject of William G. Fredrick, Sc.D., Chief Chemist, Bureau of Industrial Hygiene, Detroit Department of Health. Some of the current production problems involving such materials were included in his talk.

"Magnesium in Industry" with specific references to magnesium burns, was discussed by Frank J. Jarzynka, M.D., Medical Director, Bohn Aluminum and Brass Corporation. Dr. Jarzynka has studied the magnesium exposures in his industry for some time and presented the first of a series of papers on the industrial hygiene problems in manufacturing magnesium products. His discussion was illustrated with lantern slides in color. (See page 427.)

Chicago Section

INDUSTRIAL Hygiene and Occupational Disease Compensation" was the subject of the April 22 meeting. Compensation aspects of Occupational Diseases were discussed by Alfred J. Borah, Chairman, Illinois Industrial Commission. Legal Phases of Occupational Disease Compensation were presented by Frank R. Peregrine, Attorney. Dr. C. O. Sappington talked on Medicolegal Phases of Occupational Diseases. The annual business meeting of this section was held on June 10. The new officers are Chairman, Joseph H. Chivers, M.D., Crane Co.; Vice-Chairman, John B. Littlefield, American Brake Shoe; Secretary-Treasurer, Warren A. Cook, Zurich Insurance Companies. The new members elected to the Executive Committee were James R. Allan, International Harvester Company, Kenneth M. Morse, Illinois State Department of Public Health, Leslie Stokes, Illinois State Department of Labor, and Charles Wyman, Western Electric Company. Other members of the Executive Committee whose terms of office carry over to the coming year are Clark D. Bridges, National Safety Council, Harvey G. Hensel, Youngstown Sheet & Tube Company, A. G. Kammer, M.D., Inland Steel Company, Carl

Larson, American Air Filter Company, Edward G. Meiter, Employers Mutual Liability Insurance Company, Roy M. Moffitt, Roy M. Moffitt & Company, C. O. Sappington, M.D., and L. V. Taylor, American Can Company.

The section was fortunate in having Mr. J. J. Bloomfield, Chief, States' Relations Section, Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland, as a speaker for the evening. He presented the subject "Wartime Problems in Industrial Hygiene." In developing this subject, Mr. Bloomfield emphasized the difference between industrial hygiene in this and in previous wars. In World War I practically no attention was given to technical phases of industrial hygiene whereas at the present time 38 states and 14 cities and counties have industrial hygiene divisions. There are now some 500 technically qualified persons assisting industry in its attack on occupational disease problems in this country.

Mr. Bloomfield included off-the-job influences on health of workers in his discussion, and pointed out that particularly where industrial activities have mushroomed in many areas as in the vicinity of the ship-yards, water supply, sewerage disposal and other conditions usually taken for granted as being in order require special attention. These conditions in some instances have actually caused strikes and layoffs before they were corrected. Industrial hygiene problems are being presented in the conversion of our industries from peace to wartime operations. As examples, Mr. Bloomfield noted that sand abrasive was being widely introduced in abrasive blasting operations where metallic abrasives had formerly been extensively employed. The large scale use of x-ray for testing for flaws in castings and other metal assemblies introduces a hazard into industry formerly non-existent in our industrial plants. The investigation being made under the direction of Dr. Prendergast, at the Chrysler Corporation, on effects of noise in airplane engine testing was referred to, with the information that noise levels are reaching as high as 125 to 140 decimals in this operation.

An interesting finding mentioned by the speaker was the presence of as much as 500 parts per million of carbon monoxide in connection with a metallizing operation. It has been found that carbon monoxide concentrations tend to increase, especially in brass metallizing due apparently to excess in acetylene being used.

The war has tremendously increased the amount of radium dial painting being done throughout the country. A recent survey has shown that the very complete regulations and recommendations outlined in Handbook No. 27 of the National Bureau of Standards for protection of radium dial painters are not being followed by all of the concerns conducting the operations. In one plant in the East which had been considered a model plant for such operations, radon tests of the expired air of the workers showed that 7% of them had excessive intake of this radioactive gas. Dr. Hoecker, Physicist of the National Institute of Health, was present and answered a number of questions on exposures to radioactive materials at the close of the meeting.

In closing Mr. Bloomfield stated that the industrial hygienist must recognize the larger scope of the subject in connection with the problems of absenteeism, women in industry, tuberculosis, venereal diseases, and, where necessary, enlist the necessary assistance to cover these allied fields even though his first duty is the prevention of occupational diseases.

The highlights of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION'S Annual Meeting were presented by Milton H. Kronenberg, M.D., Director, Division of Industrial Hygiene, Illinois State Department of Public Health, who represented the Section as a member of the A. I. H. A. Local Section Council at the Annual Meeting.

This meeting brought to a close a successful series of eight dinner meetings held monthly throughout the year by the local section. These meetings were well attended, from 60 to 80 representatives of industry and others interested in industrial hygiene being in attendance. The programs have usually included more than one speaker, so that the several aspects of a given subject would have an appeal to industrial physicians, technical industrial hygienists, plant engineers, safety engineers charged with control of occupational diseases, and plant supervisors. The diversity of the group attending the meeting permitted discussion of various phases of the subject, which added greatly to the interest and value of these meetings.

The Problem of Industrial Hygiene

JAMES G. TOWNSEND, M.D.,
Bethesda, Maryland

JUST as swift-moving events in our variegated warfare change the kinds of weapons used in combat, so circumstances change our problems on the home front. Shortages and priorities, for example, have put new solvents of unknown toxicity on the market. Old materials, such as benzol and carbon tetrachloride, have come into greater usage.

One company, for instance, had gradually restricted the use of benzol to the point where none was used in their plants. Recently, their industrial hygienists found that benzol was being used in a new process for polishing reflectors. The present operations personnel, never having had any experience with benzol, were surprised to learn that it a toxic substance. A few trial runs showed that a solvent naphtha could easily be substituted. They have since improved the properties of the compound used, proving that production gains may sometimes be made by investigating hazardous materials.

In many cases, benzol is replacing the less toxic toluene which is being used as a starter in the manufacture of TNT. Our engineers have just completed a survey on benzol, indicating its hazards, industries wherein they exist, and standard methods of control which can be applied in any size plant.

We are now studying a mixture essentially of benzol and toluene, containing in addition a small percentage of other aliphatic and aromatic hydrocarbons. It has been advocated as a substitute for toluene, with the claim that with this mixture the toxicity of benzol is attenuated to such an extent that it is not liable to cause chronic benzol poisoning. In order to protect the health of workers handling these materials, it appeared imperative to check on the validity of this claim, because it is contradictory to past experience.

Increasingly large quantities of chlorinated solvents such as carbon tetrachloride and trichlorethylene are being used in vapor degreasing of metal parts. Control of these vapors in most degreasing tanks has in the past been accomplished by condensation methods. Now we frequently find that the production pace has been stepped up so high that cooling coils cannot be kept below the temperature required for satisfactory condensation. Consequently, workroom air is contaminated. If additional cooling capacity cannot be provided, use of local exhaust ventilation and, if possible, enclosure of the process are recommended.

Recently, in one plant it was found that small percentages of trichlorethylene would serve as well as the more dangerous carbon tetrachloride —another example of new production gains through investigation of dangerous materials.

Lead tetraethyl is being used in the lower grades of gasoline to increase the octane rating of motor fuel. This would not be very important if it were not for the fact that these gasolines have been used throughout many plants for various washing purposes. This means that the men get their hands, and sometimes portions of their bodies, in contact with gasoline which now contains an extremely toxic lead compound which can be absorbed through the skin.

Gasoline containing tetraethyl lead has been widely used in stoves in trailer camps where large numbers of industrial workers live. Unless this practice is eliminated, serious injuries may develop wherever trailer camps are located. In Maryland the authorities have conferred with representatives of the oil industry, and lead-free

Part of the text of DR. TOWNSEND'S presentation at the Seventh Annual Meeting of the New Orleans Graduate Medical Assembly, March 15-18, 1943, at New Orleans; published in *New Orleans, M. & S. J.*, May, 1943.

gasoline is now available to trailer residents, who have been warned.

Certain metals used in airplane and munitions construction constitute various health hazards. For example, the demand for mercury, used in the manufacture of munitions and precision instruments, has resulted in reopening old quicksilver mines, where operations have begun without installing the equipment necessary to prevent dissemination of mercury vapor and dust.

Metal spraying operations expose operators to hazards from metal fumes of all kinds, including lead. Such operations should be performed only in booths equipped with proper exhaust ventilation.

Alloys of unknown or implied industrial hygiene significance, and toxic metals, such as cadmium, are replacing aluminum and chromium. Control of possible fumes or vapors is indicated in these cases.

Tellurium, which has known toxic properties, is being used for special steel alloys. If toxic concentrations of tellurium are detected, control can probably best be secured by local exhaust ventilation.

Among the studies under way on the toxicity and potential dangers of the heavy metals and their compounds are those on beryllium, vanadium, and molybdenum. These metals are becoming increasingly important because of the unusual mechanical properties of some of their alloys. These studies were undertaken because sufficient data were not available for an evaluation of permissible concentrations.

The silicosis hazard associated with abrasive blasting operations is increasing in magnitude since it has become necessary in both new and old installations to return to the use of silica sand as an abrasive instead of steel shot or grit. However, the sand blaster can be protected if properly designed and well maintained.

The substitution of silicon carbide cutting instruments for those of steel, as well as the replacement of cutting and milling with abrasive grinding processes, introduces new dust hazards which may be detrimental to the health and will certainly affect production.

The enormous demand for precision instruments in war production has reintroduced the threat of radium poisoning among luminous dial painters, as occurred during World War I. This problem is made especially difficult by the sub-contracting system which has spread the work among many small shops in many states, without leaving any central source of information as to the location of these industries. Recently, the National Bureau of Standards has issued a Handbook (H27), setting forth in considerable detail the precautions to be taken in the safe handling of radioactive luminous compounds. The significant point is that radium dial painting can be done safely, if industries are aware of the danger and follow standard precautions.

One of the serious industrial hygiene problems is control of the hazards resulting from the electric welding arc. The production drive has multiplied its use many times without multiplying the protective equipment.

The hazards of the electric welding arc are many. Burns, electrical or from molten metal, may occur. The effects of ultra-violet radiations from the flash of the arc are dangerous. Oxides of nitrogen fixed by the arc may cause severe and even fatal poisoning. Metal fume fever may result from breathing certain metallic oxide fumes produced when welding galvanized iron. There is the danger of exposure to carbon monoxide and other products of incomplete combustion from the coating of the welding rod. We are also familiar with the possibility of lead poisoning when painted parts are to be welded or cut, and with the ill effects of fluorides when welding stainless steel.

Effective methods for the control of all these hazards are known, but their application has been "too late and not enough" in many instances. While it is true that the supply of protective and control equipment has not kept pace with the demand in some cases, other means for securing protection could have been devised. Frequently, insufficient measures have been taken to shield the arc and protect other workers in the vicinity from welding flash, or to remove toxic gases and fumes by local exhaust ventilation.

The tremendous acceleration in industry is reflected by an exaggeration of old familiar dermatoses problems. The search for substitutes for priority materials has led to new cutaneous exposures. These substitutes may expose not only industrial workers, but the Armed Forces and the civilian population who use their products.

Dermatitis is the chief industrial hazard in munitions plants. Most of the explosives such as TNT, DNT, tetryl, ammonium picrate, and fulminate of mercury, belong to the class of compounds known as skin sensitizers. By this is meant that certain individuals having cutaneous exposure to these compounds develop a specific hypersensitivity, following an incubation period of several days or longer, after which they develop dermatitis whenever they have cutaneous exposure to the specific compound. Among the explosives, tetryl is the most powerful sensitizer, the percentage of workers affected being estimated at anywhere from 10 to 30%. The degree of cutaneous exposure necessary to induce hypersensitivity does not bear any relationship to safe toxic limits for systemic exposure.

The control of dermatoses from explosives resolves itself into reducing the cutaneous exposure of workmen to these compounds by the use of protective clothing, protective ointments, and attention to personal environment cleanliness. Our Dermatoses Investigations Section has developed special clothing, ointments, and cleansers for this purpose.

In the manufacture of airplanes, skin hazards encountered are in the degreasing solvents and compounds, cutting oils, paint and "dope," and electroplating baths.

The solvents which are used in degreasing metal parts and as paint and "dope" thinners often cause dryness and fissuring of the exposed skin due to loss of the natural oil and fat extracted by these compounds. Degreasing tanks and mechanical cleansing equipment, as well as protective clothing, will remove this hazard.

Metal plating and other rust-proofing processes are carried on in airplane plants, furnishing potential skin hazards from alkaline cleansing and degreasing baths, acid baths, and solutions in the plating tanks themselves. The Division of Industrial Hygiene has devised special venting apparatus for plating tanks, which, in addition to protective clothing and ointments largely removes the skin hazards in these processes.

Cutting oils are another skin hazard. The mechanization of modern armies calls for the production of much mechanical equipment, which involves considerable metal work, a large part of which necessitates milling and machining. The use of cutting oils is essential to these operations, and the machinists have a certain amount of unavoidable exposure to these oils. A certain percentage of these machinists develop comedones, folliculitis, acne, boils, and sometimes, eczemas of those skin areas exposed to the oils. Wounds from steel cuttings may afford portals of entry for infection. It is not the bacteria in cutting oils which cause these conditions, but rather bacteria on the skin and dirty clothes. Therefore, we do not advocate the addition of disinfectants to cutting oils. Environmental and personal cleanliness, protective clothing when necessary, and filtration of the cutting oils to remove the steel cuttings are the principal measures for preventing cutting oil dermatitis.

Recently we have encountered a new form of cutting oil dermatitis. The lesions are not only of a different character, but the face and neck are frequently involved, which is not usual in the ordinary type of cutting oil dermatitis. This problem is now under investigation, but present indications are that eruptions of this type are associated with the organic chlorine compound content of some cutting oils.

One industrial problem which deserves special attention with the increase in the horsepower of airplane motors, is the problem of excessive noise. High sound intensities long continued may cause deafness. In the past, the testing of motors was kept to a 90 decibel level or lower. But with airplane motors of 2000 horsepower and upwards, the test rooms may have noise levels from 120 to 140 decibels, even though scientific methods of sound deadening are used.

One solution is the installation of sound deadening baffles about the pipes and motor on a hinged arrangement, allowing for ready access to all parts of this equipment. Sound deadening ear plugs could be used. One company whose employees are exposed to high levels of sound gives special physical examinations to detect injury before it becomes serious.